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Layovers in Underdeveloped Countries Increase Risk of Contracting Infectious Diseases

Diseases that are rare or virtually nonexistent in many developed countries are widespread in some other parts of the world. Crewmembers flying to countries where such diseases are prevalent can protect themselves from infection through vaccination and medications. Prior knowledge of the risks to be encountered at destinations, and of preventive measures available, can reduce risk by a large measure.

Stanley R. Mohler, M.D.
Wright State University School of Medicine
Dayton, Ohio, U.S.

International travel by aircraft crewmembers involves potential exposure to bacteria and viruses that probably would not be encountered in the crewmembers' home country. The risk of contracting a disease while visiting international locations varies with each location's food preparation, drinking water, disease-carrying biting insects, epidemics and other considerations.

According to statistics published by the Medical College of Wisconsin (Milwaukee, Wisconsin, U.S.), travelers' diarrhea occurs in 40 percent to 50 percent of travelers from developed countries to underdeveloped countries. Data predict that, for every million people making a one-month stay, about 24,000 would contract malaria in West Africa; about 500 would acquire malaria in South America. About 3,000 travelers to underdeveloped countries would be infected with hepatitis A, and about 300 visitors to Africa or India would contract typhoid fever.[1] Although any one layover represents considerably less time, these figures might well represent cumulative exposure for a number of layovers.

Appropriate vaccinations and an individual's application of common sense and health-education principles will minimize the likelihood of contracting a disease during international travel.

In addition, over-the-counter and prescription medications can be carried that, if used according to instructions, will minimize the likelihood of contracting specific diseases. The medications also can reduce or eliminate symptoms without impairing crewmembers' ability to perform their duties.

An ill pilot should not fly and should seek advice from the company's medical personnel. An operator should have arrangements in the countries to which its crews fly, so that medical attention can be provided when needed. In addition, each operator should provide guidance so that its crewmembers receive proper health education, necessary vaccinations and other preventive measures prior to undertaking international flights.

Even if the operator's guidance for its crewmembers is less than complete, a number of sources can fill information gaps.[2–6] Information is available from various public health service offices — national, regional and local. These agencies also can provide vaccinations, or advise where vaccination is available. Up-to-date information about health risks at destinations and prophylactic measures is also available from the U.S. National Center for Infectious Diseases, Centers for Disease Control and Prevention (CDC)[3,6] and its equivalents in other countries, such

as the Travel Medicine Program of Health Canada[7] and the U.K. Public Health Laboratory Service, Travel Health Unit;[8] the World Health Organization;[9] and the International Association for Medical Assistance to Travellers.[10]

Following is a brief overview of major health hazards to which crewmembers may be exposed during travel to underdeveloped countries and means of avoiding or limiting the likelihood of illness. The advice applies to most people, but a physician should be consulted to determine whether a specific vaccination, medication or other health care is appropriate based on individual health factors.

In exposure to these diseases, the severity of the symptoms or the danger to the individual depend in part on the status of the individual's natural immune system. A person's immune system that is weakened by, for example, another disease or by aging is likely to increase the seriousness of a disease acquired in an underdeveloped country.

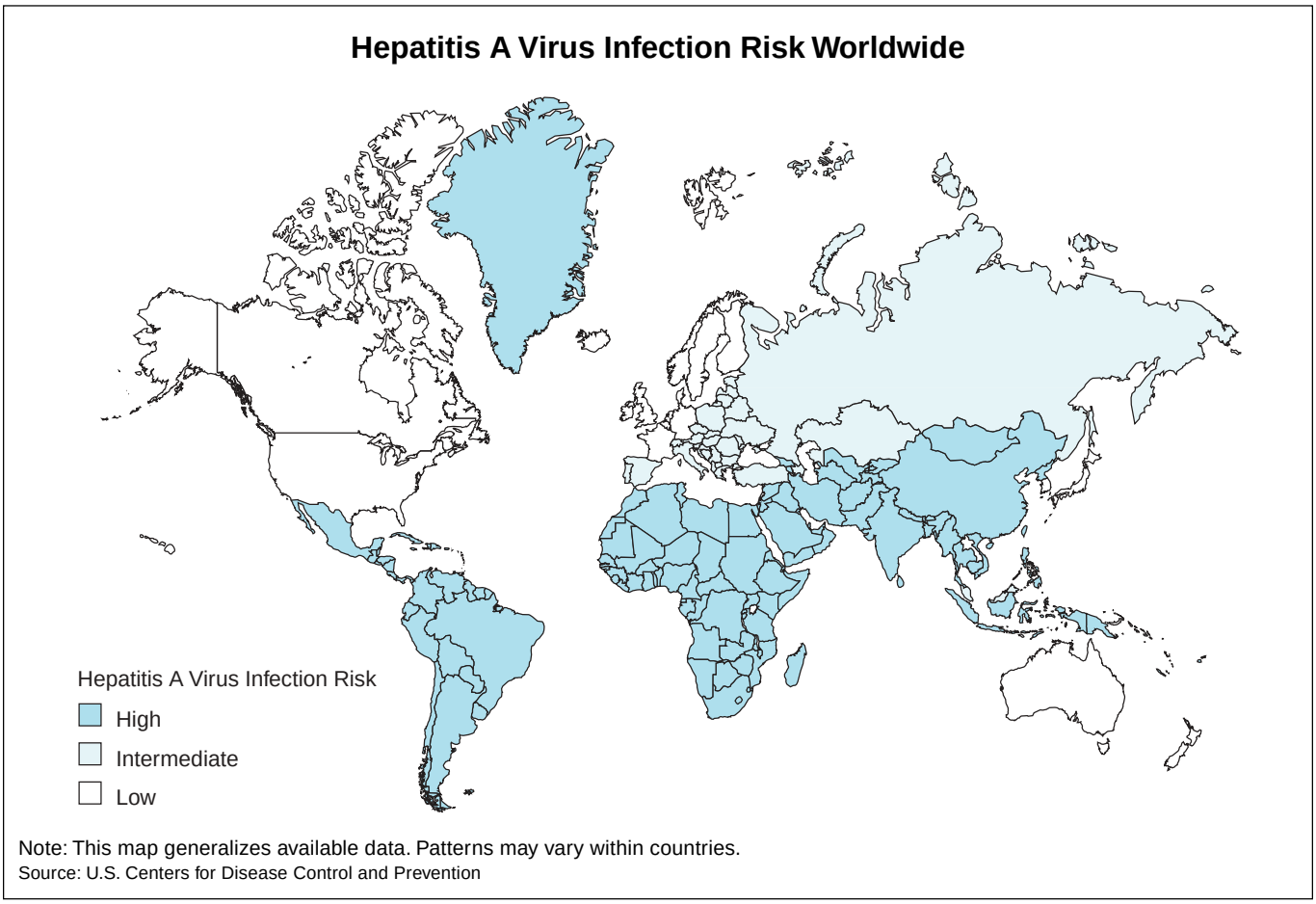
Hepatitis A. Travel to many underdeveloped countries presents a higher risk of consuming food and/or drink contaminated with hepatitis A virus. At such destinations (Figure 1), hygiene — including that for food preparation — is often less than adequate. Also, leakage from sewage systems into drinking-water sources and conduits can contaminate a public water supply.

"Recent studies have shown that many cases of travel-related hepatitis A occur in travelers with 'standard' tourist itineraries, accommodations, and food and beverage consumption behaviors," said the CDC.[6]

When swallowed, the hepatitis A virus may infect the intestinal lining and make its way to the liver. The virus then may inhabit the digestive tract, including the liver. A person's immune system–generated antibodies may overcome the virus, and the infected individual does not become ill and never knows of the exposure.

Nevertheless, if the hepatitis A virus overwhelms the immune system, liver cells might enlarge in reaction to the multiplication of the virus. The enlargement causes tiny bile ducts that carry bile through larger ducts to the gallbladder to close because of pressure on duct walls. The bile backs up instead of being eliminated through the bowels.

Red-blood-cell hemoglobin, normally broken down by liver cells into smaller molecular components and delivered into the bowels, then is not broken down adequately or delivered



Note: This map generalizes available data. Patterns may vary within countries.
Source: U.S. Centers for Disease Control and Prevention

Figure 1

to the gallbladder. Accordingly, circulating blood carries these components, which give the skin a yellowish tinge known as yellow jaundice. Almost all of those who are otherwise healthy and who acquire hepatitis A recover.[11]

There are also potential sources of hepatitis A in developed countries. Examples include raw oysters, shellfish and other seafood that, because of untreated sewage runoff, may harbor viruses passively, because these aquatic creatures live in the contaminated water. Unhygienic conditions can be present in any country, and if a food preparer has the virus, whether in a home or in a restaurant, there is risk of spreading hepatitis A infection. The liver of a person who has the virus is also susceptible, with repeated alcohol use, to developing cirrhosis.

According to the CDC, two hepatitis A vaccines are licensed in the United States.[6] About four weeks are required after vaccination for immunity to be assured. An alternative medication, immune globulin, can be given between three days and five days prior to departure, but its protection will last only months, rather than the years of protection offered by the vaccines.

Typhoid fever. American aviation pioneer Wilbur Wright died of typhoid fever in 1912, three weeks after contracting this intestinal illness caused by the bacterium *Salmonella typhi* (*S. typhi*). His immune system was unable to counter the overwhelming body infection, apparently resulting from food eaten during a trip to a U.S. city.

During the early part of this century, some people were found to harbor the typhoid-fever bacteria in the gallbladder, and they could transmit bacteria to others, even though they were essentially free of symptoms. One famous cook, whose name was Mary, moved from restaurant to restaurant during her career, unknowingly spreading this often-fatal disease to patrons because her bacteria-contaminated fingers contacted the food. The newspapers gave her the nickname "Typhoid Mary," which the public applied to any carriers of the disease. Laws soon were passed in New York, U.S., and elsewhere to prohibit such individuals from working in restaurants.

The disease can be fatal, especially among the more vulnerable (e.g., the elderly). Even a few patients who are treated succumb.[11]

Today, travelers to underdeveloped countries need protection from the bacteria that causes this disease, which can also be carried in food, milk and water.

"You can get typhoid fever if you eat food or drink beverages that have been handled by a person who is shedding *S. typhi* or if sewage contaminated with *S. typhi* bacteria get into the water you use for drinking or washing food," said the CDC. "Therefore, typhoid fever is more common in areas of the world where hand washing is less frequent and water is likely to be contaminated with sewage."[6]

A typhoid-fever vaccine has been available for decades, and is given by injection.

Tetanus and diphtheria. Tetanus is caused by *Clostridium tetani*, one of the bacteria of the class called anaerobic because they live in low-oxygen or nonoxygen environments such as bodily abscesses [areas where there is a lack of blood flow and, therefore, a lack of oxygen].

Symptoms of tetanus infection include jaw stiffness (responsible for the alternative name, "lockjaw"), muscle spasms or rigidity, and restlessness.[12] The disease is often fatal if untreated.[11]

Diphtheria is primarily a disease of the respiratory system. It is seldom fatal; nevertheless, the bacteria that cause diphtheria also produce toxins that can seriously damage the heart, nervous system and kidneys.[1]

Crewmembers who matured in developed countries will likely have had childhood vaccination for tetanus and diphtheria. During the decade following a vaccination, however, some weakening of the immune system against these two conditions occurs. Therefore, those flying to underdeveloped countries, and also to Russia, Kazakhstan, Uzbekistan and Ukraine, should have a toxoid [a weakened version of toxin, which helps the body re-establish immunity] booster for these two diseases prior to travel. Diphtheria epidemics have been occurring in these regions because of public health–infrastructure failures and the emergence of sizable numbers of nonimmune individuals who are the source of contagion.

Poliomyelitis. Poliomyelitis, or polio, is a viral infection that can cause loss of muscular tension and paralysis. Polio virus, like the hepatitis A virus, infects the gastrointestinal tract. If the infected individual does not build immunity, the virus multiplies, circulates in the blood and attacks nerve cells in the brain, spinal cord or both. At worst, the disease results in paralysis, though not fatality.[11]

If an individual has not been vaccinated against polio, an initial vaccination with enhanced inactivated polio vaccine typically is recommended prior to visiting underdeveloped countries.

If an individual has been vaccinated against polio, a booster of enhanced inactivated polio vaccine or trivalent polio oral vaccine (attenuated living virus) should be considered. Until polio is eliminated throughout the world (as smallpox has been), persons who are not vaccinated against polio are at high risk during travel in underdeveloped countries.

Meningococcal meningitis. The meninges are the membranes covering the brain and spinal cord; when the meninges are infected by bacteria, the result is meningococcal meningitis. The infection can result in seizures, coma or shock, and can be fatal if untreated.[1]

Throughout nondesert equatorial Africa, the environment and living conditions are conducive to person-to-person respiratory transmission of the infectious bacterium for meningococcal meningitis. The same is true for much of India and for Nepal. Epidemics of this disease periodically erupt throughout these areas.

Those whose immune systems do not resist the meningococcal bacterium typically become ill and die. Those whose immune systems can overcome the bacterium have long-term immunity.

Some persons develop a *détente*, or stalemate, with the bacterium, and, although not ill, become carriers. These individuals can then infect others.

Thus, it is recommended generally that crews traveling to the areas cited above receive meningococcal vaccine.

Cholera. Cholera bacteria produce a toxin that causes a dysfunction in the small intestine, including loss of fluid from tissues and an increased secretion of salts and minerals. Symptoms range from diarrhea and vomiting to intense thirst, muscle cramps and weakness. Dehydration causes difficulty in urine production. Cholera can cause kidney failure, shock and coma, and severe cholera can be fatal.

In some underdeveloped countries, epidemics of cholera occur periodically, against the background of a low-level, endemic (common among the population) cholera (Table 1, page 5). Nevertheless, crewmembers staying in modern hotels do not have a significant risk of contracting cholera during layovers. The avoidance of raw seafood in these countries is an important precaution.

Yellow fever. When flying to equatorial Africa or to equatorial and southern South America (Table 2, page 5), yellow-fever vaccination is recommended. Yellow fever is caused by a mosquito-carried virus. Its symptoms include fever, bleeding and jaundice. The disease can be fatal.

Hepatitis B. Hepatitis B, another liver infection caused by a virus, is transmitted by contact with blood or body fluids from an infected person. It is occasionally fatal, especially in the elderly.[12]

Nonsterile equipment and failure to follow universal precautions (including, for example, new latex gloves for each patient) in medical and dental offices can transfer hepatitis B virus from an infected person to an uninfected person. Hepatitis B can also be transmitted sexually.

Generally, it is not necessary for crewmembers to receive hepatitis B vaccination unless dental work is anticipated in an underdeveloped country or unsafe sex practices are contemplated. Any risk factors for sexually transmitted diseases should be discussed frankly with a physician.

Malaria. Crewmembers should consider the risk of malaria in relation to the destinations where layovers occur. Malaria — transmitted primarily by the bite of the *Anopheles* mosquito — exists in Latin America, Central America, Africa, the Near East and Asia.

"Symptoms of malaria include fever, chills, headache, muscle ache and malaise," said the CDC. "Travelers who become ill with a fever during or after travel in a malaria-risk area should seek prompt medical attention and should inform their physician of their recent travel history."[6] Malaria can be fatal.[11]

The local incidence of malaria infection changes year to year, however, with respect to the development of resistance by certain malarial organisms to the prophylactic (preventive) medications in use. Accordingly, consultation with a public health department is necessary to obtain the latest recommendations.

Travelers' diarrhea. A day or two after arrival, visitors to underdeveloped countries commonly experience intestinal discomfort followed in several hours by loose stools and diarrhea. In the absence of treatment, the symptoms generally last for a few days, and sometimes for more than a week, until the immune system can organize specific resources and overcome the infectious agent causing the symptoms.

This agent is most commonly one or another strain of *Escherichia coli* (known as *E. coli*) to which the visitor has not been exposed previously.

The bacterium contaminates food products and drinking water under unsanitary conditions. A visitor who drinks contaminated tap water, uses ice made from this water or brushes the teeth with such water — or who eats contaminated fresh vegetables or fruit — swallows some of the *E. coli* bacteria. The result is as if the bacteria, on discovery that there are no immune-system "policemen" around to stop them, set up housekeeping in the intestines and multiply. (The metaphor is oversimplified, but is essentially accurate.)

Next, a toxic reaction occurs in the traveler's body, and this triggers diarrhea, which helps purge the intestinal tract of the toxins. Usually, immunity then develops and the bacteria are subdued. This immunity can last for decades, so natives of the region generally can drink water from public systems and consume fresh vegetables and fruit, and not become ill.

In many underdeveloped countries, first-class hotels often provide purified tap-water systems. Generally, however, drinking sterilized bottled water and brushing the teeth with bottled water are recommended as prophylactic measures. Travelers should be wary of drinking bottled liquids with ice because the frozen water may be contaminated. Moreover, the alcohol in some beverages does not kill the bacteria in the beverage and prevent illness.

Table 1
Cholera-infected Countries

Africa
Angola
Benin
Burkina Faso
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Comoros
Congo
Côte d'Ivoire
Democratic Republic of Congo
Djibouti
Ghana
Guinea
Guinea-Bissau
Kenya
Liberia
Malawi
Mali
Mauritania
Mozambique
Niger
Nigeria
Rwanda
Sao Tome and Principe
Senegal
Sierra Leone
Somalia
Swaziland
Tanzania
Togo
Uganda
Zambia
Zimbabwe

East Asia
China
Mongolia

Southeast Asia
Cambodia
Laos
Malaysia
Myanmar
Philippines
Vietnam

South America
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
French Guiana
Guyana
Peru
Suriname
Venezuela

Central America
Belize
Costa Rica
El Salvador
Guatemala
Honduras
Mexico
Nicaragua
Panama

Indian Subcontinent
Afghanistan
Bhutan
India
Nepal
Sri Lanka

Middle East
Iran

Source: U.S. Centers for Disease Control and Prevention

Table 2
Yellow Fever–infected Countries

Africa	
Angola	Provinces: Bengo and Luanda
Benin	Department: Atakora
Cameroon	Northern Province
Democratic Republic of Congo	North of 10 degrees south
Gabon	Ogooue'-Ivindo Province
Gambia	Upper River Division
Ghana	Upper West Region
Guinea	Siguiri Region
Liberia	Boma County, Bong County, Bassa County, Sinoe County
Nigeria	States: Anambra, Bauchi, Bendel, Benue, Cross River, Imo, Kaduna, Kwara, Lagos, Niger, Ogun, Ondo, Oyo and Plateau
Sierra Leone	Kenema District
Sudan	North of 12 degrees north

South America	
Bolivia	Departments: Beni, Cochabamba, La Paz and Santa Cruz
Brazil	Territories: Amapa; States: Amazonas, Maranhao, Para
Colombia	Departments: Antioquia, Boyaca, Cesar, Choco, Cundinamarca, Norte de Santander, Santander and Vichada; Intendencias: Arauca, Caqueta, Casanare, Cucuta, Guaviare, Meta and Putumayo
Ecuador	Provinces: Morona-Santiago, Napo, Pastaza, Sucumbios and Zamora Chinchipe
French Guiana	Saint-Laurent-du-Moroni region
Peru	Departments: Amazonas, Ancash, Ayacucho, Cusco, Huanuco, Junin, Loreto, Madre de Dios, Puno, Pasco, San Martin and Ucayali

Source: U.S. Centers for Disease Control and Prevention

Over-the-counter Immodium® or Pepto-Bismol® (tablets or liquid) may be taken on trips for symptomatic relief.

Armed with knowledge about the specific disease risks of the areas to be visited, crewmembers can obtain the necessary vaccinations or vaccination boosters prior to travel.

During visits to areas with known prevalence of certain diseases, the informed traveler can use common sense to minimize the possibility of exposure to infectious agents.

Certain over-the-counter symptom-relief medications and prescription medications may be carried. It is important that

judgment be applied in the use of these medications, because side effects could have an adverse effect on the performance of a crewmember's duties. Advice from a physician, prior to traveling, about the use of the medication is wise.♦

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9. World Health Organization, Avenue Appia 20, 1211 Geneva 27, Switzerland. World Wide Web site: www.who.int/.

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About the Author

Stanley R. Mohler, M.D., is a professor, vice chairman and director of aerospace medicine at Wright State University School of Medicine in Dayton, Ohio, U.S.

Mohler, an airline transport pilot and certified flight instructor, was director of the U.S. Federal Aviation Agency's Civil Aviation Medicine Research Institute (now the Civil Aeromedical Institute) for five years and chief of the Aeromedical Applications Division for 13 years.

Mohler received the 1998 Cecil A. Brownlow Publication Award for journalism that enhances aviation-safety awareness.

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